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ABSTRACT

Part of a larger study on pre-school children's ability to use the computer to create art, a study examined the language children used as they were exposed to and trained to use a computer software program. Subjects were 4 preschool children (4 or 5 years of age). Audio and video recordings of the children over 8 sessions yielded a total of 1,501 protocols for analysis. A coding system including the four basic language functions--Child Directed, Child Informing, Child Inquiry, and Expressions--was used to code the data. Results indicated that: (1) the computer experience provided an opportunity for a wide range of language use; (2) children were highly interested in the computer class; (3) language used peaked once the children became comfortable with the software; and (4) language was used to work out solutions and to solve problems. Findings suggest that children were fascinated by the computer graphics and quickly learned the instructions and activities necessary to use the medium. (Contains 15 references, and 1 table and 1 figure of data.) (RS)

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What the Children Said:

An Analysis Of The Children's Language During Computer Lessons

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Introduction

When personal computers were first introduced in the preschools there were number of concerns about its role in early childhood programs. Some researchers felt that the computer was an antisocial element because it isolated the child. Others were concerned about its effect on the creative development. However, there is a growing body of literature that shows that children as young as three to four years are able to use computers and benefit from them (Brett, 1994; Clements, Nastasi and Swaminathan, 1993). Children who find the computer activity interesting and experience success with it want to share their experience with others by talking with them and showing them what they have done. Their interest and enthusiasm encourages others to join in. A computer in a preschool classroom can provide a focal point for social interactions (See Brett, 1994 for a review). At times children may play alone at the computer just as they do with other traditional materials (Escobedo and Bhargava, 1991).

With a growing availability of computers in preschools, the relevant concerns are how to integrate these meaningfully in the preschool curriculum (Landerholm, 1994; Papert, 1993). Davis and Shade (1994) in their review on computers in the early childhood curriculum note that a crucial part is the introduction of the computer in the classroom. Vygotsky (as referred to by Berk and Winsler, 1995), stated that new capabilities in the child are developed in collaboration with the adult or more competent peers and only later internalized to become part of the child's way of thinking. While working with children, the teacher acts as an instructor and a coach, thus providing the "zone of proximal development" and guiding them through the new software and facilitating transfer of control to the child.

In this paper we provide a detailed analysis of this process. It is based on the content analysis of the verbal protocols recorded during the exposure and training of children in a lab setting. These language cues provide an important glimpse of the process that children go through in mastering this medium. As these language cues are unrehearsed, these represent an important evidence of the issues and concerns important to the children.

In order to analyze the language used by the children, this paper begins by developing a typology of language based on past literature. This typology serves as a means of coding the process into "chunks" of observations based on the language used. The typology is illustrated with a number of examples, an overview of the process, followed by conclusions and implications for further research are included.

Theoretical Basis of the Typology of Language

In order to analyze the protocols, we first needed to develop a typology of the language usage to facilitate an understanding of the data and to help code it. The relevant antecedents (theory) for developing the typology are briefly summarized below.

Children's language arises out of the experiences that have meaning for them. Halliday (1973) refers to the functions of language, and views the primary significance of dialogue as functional. It allows the child to master the purely communicative function of language. According to Halliday (1973) the child uses language in a variety of ways, for the satisfaction of needs, for the mediation of personal relationships, the expression of feelings etc. Accordingly he describes seven functions of language - instrumental, regulatory, social interaction, personal, heuristic, imaginative and the representational function.

Another prominent classification of language functions has been developed by Tough (1977). She defines functions as the means by which a purpose is achieved. The purpose of language is to express and construct meaning. A child uses language according to his developing conceptualization of the world around him. Tough's classification include four major functions namely the directive, interpretive, projective and the relational function.

Beaty and Tucker (1987) strongly believe that certain programs stimulate the use of words, expand the use of familiar words and help children make up stories to go along with their computer depictions. They believe that not only the computer programs themselves, but also the chance to converse with a partner encourages children to learn language while at the computer. This study looks at communication patterns used by children while working at the computer.

Some of the early language at the computer sounded like what Piaget would describe as self talk. This conversation is not directed at anyone in particular. Psychologists who have studied private speech found it to be a transitional phase between internal thought and verbalized speech (Berk, 1985). After a while private speech becomes more socialized and directed towards the partner.

Based on these typologies, a coding system including the four basic language functions - Child Directed, Child Informing, Child Inquiry and Expressions was used to code the data. The broad categories were then further subdivided and modified and refined until the coding system that was suitable to this study was finalized. Using this data, the specific research questions that are covered in this study are:

Q1. What were the types and frequency of language functions used by the children while learning the computer program?

Q2. What are the "characteristics" of the language used by children in learning a program? In other words, what are some of the concerns that the children express in learning a new software program?

Q3. What were the differences in the language functions over the sessions?

Methodology and Procedure

The data for this study is collected as a part of a larger study on pre-school children's ability to use the computer to create art. This larger study involved exposing the children to the tools and functions of a computer software program that could be used to create art (Escobedo and Bhargava, 1991 for details). Data was collected during 8 one and half hour sessions held weekly in an observation room in the college of education. The subjects in the study were four children, 2 females (a 4 year old and a 5 year old) and two males (a 4 year old and a 5 year old).

The primary source of data for this study was the language (recorded on video and audio tapes) of the children as they worked on an art program on the computer. An Apple computer was hooked up to a videotape and with the help of a microphone, the language used by the children was recorded. Audio recordings were made of these videotapes and they were used to transcribe the data. The transcribed data was transferred to a software program and formatted for computer retrieval. A spreadsheet program was used to sort the data and count the frequencies. Details of this language typology used to code the process are given in Table 1.

Insert Table 1 About Here

A total of 1501 protocols were recorded across the eight sessions and four children and form the unit of analysis for this paper.

Results

The study of the 1501 protocols recorded during the computer sessions revealed that the children used informative and directive functions of language to convey their ideas.

Child Directed Language

During the computer sessions 30% of the language used was noted as being in the child directed category. Responses were coded as being child directed when they were used by the children to take control of the situation. Such language was used to direct others as well as the self. The child directed responses were then further subcategorized. The sub categories included language used to *focus attention*:

J-T Now look what I'm doing or

K-T That's a little bitty collar, see it?

to give directions,

J-W The thing to do before the last thing is to erase a little bit at the top.

to make requests,

K-T Could you please be over here.....

to state intent,

J-T I'm gonna put some decorations on there.

to state desire

L-T I wanna make a little picture.

K-T I think I need the typewriter.

to state preference,

L-T I don't want green, I want red.

to indicate personal feelings:

W-T Its kind of hard to see

in the form of self talk:

J- Now get back to red

L- okay, one key at a time.

Child Informing Category

32% of the utterances were in the child informing category. Responses in this category included language used by the children to provide information about the computer or about the work they had been doing. Such language was used to report on experiences, to make statements, to convey facts and knowledge , to reason, to explain and to report.

In this category language was used to indicate *an ability to perform a task:*

J-T I did that all by myself !

K-T I know how to do that.

to describe the depiction being produced:

K-T A horsey in the snow.

L-T Its a pie.

W-T I made a wolf face.

to evaluate work done by self, others and the computer:

K-T This is pretty !

J-T Wow, that was cool.

to give explanations:

J-T Yes, this is to hold it up

to indicate knowledge:

L-T I know how to spell it

J-K K, I know what that is.

This category also included language used to *state facts about the computer:*

K-E Its making squares.

K-T The computer tries to do it but it can't.

to reason:

J-T But black won't work on black.

J-T I can't choose paint can, I'm already on it.

Child Inquiry

Responses were coded in the child inquiry category when they were used by the children to acquire knowledge. 9% of the language used was in this category. They were in the form of questions, and had the intent of leading to answers. The sub categories included,

questions to seek clarifications:

W-T How could this be ?

K-J But how did you get the white dots?

questions seeking confirmation:

W-T That one?

K-E So do I have to get this little guy and put it over here ?

J-T Cancel?

questions seeking explanations:

W-T How did you clear it ?

K-E What are these colors for?

questions regarding spellings , keyboard etc.:

L-T What comes after PL in Polly?

and *self-directed questions*:

J- Is this gonna trick me ?

J- What color have I not drawn with ?

Expressions

Language was coded in the expressions category when it was used to express emotions and to react. Some of the emotions expressed were those of *frustration:*

L-T Hey, that was dumb.

J-T Darn I did'nt want that

expressions of excitement:

K-T Cool, I'll have to save this picture

expression of surprise

L-T Hey, what is that?

J-T I don't know how I did that

expressions of interest:

K-T Very, very interesting!

expressions of success:.

L-T I wrote my name

W-T Look what I'm doing!

11% of the utterances were in the form of expressions.

Of the total amount of language used 4% was unrelated to the computer class and 15% of the utterances could not be coded.

The two older children were more vocal and thus provided a clearer understanding of their mastery over the computer as well as its functions and capabilities. All the children used language to focus attention on what they had accomplished. An analysis of the children's language revealed that the amount of language used that was unrelated to the computer class was minimal (4%), indicating that the children were interested in the computer class and the task at hand. The number of questions asked revealed their interest in understanding how to use the computer.

Characteristics of language used

Researchers have concluded that preschool children can solve problems, manipulate machines, master skills and be powerful in a well designed computer environment. (Swigger and Campbell, 1981; Wright And Samaras, 1986). As the computer classes progressed it was noted that the children worked out problems by themselves, and then proceeded to explain the process to the other children. For example in one of the sessions the older male figured out a way to get a colored-patterned background.

J-K ....I got the paintcan and dumped that , and then I got the pattern with the dots on it , and I dumped that .....

K-J But how did you get the white dots?

J-K White dots was on the pattern.

The language used while working at the computer indicated a high level of interest, both in the capabilities of the computer and in manipulating the software program to do what it was that they wanted it to do. During the eight sessions 6-15% (average 8.6%), of the utterances were in the form of questions used by the children to seek explanations, clarifications and confirmations.

In the beginning of the study there were fewer utterances that revealed preplanning on the part of the children with regard to their creations on the computer. At this time it seemed that the children were experimenting with the computer, not quite sure how they would manipulate it. However, as time progressed, the children spoke about what they wanted to make and then proceeded to execute their intentions, for example:

J-T I'm going to do something neat.....yeah I'm making a spider's web.....actually I'll call it a cobweb.

T-J A cobweb!

J-T Because cobwebs don't look like spider webs. Cobwebs are like crazy.... Now I know what I'll do....oops,...make a spider.

T-J Oh, you're using purple to make the spider.....looks like you're drawing some spider legs right now.

J-T I am....That's his head.....Now I think I'll get some more black for his web.....I've got o be careful not to do it on the spider.

The children also used graphic expressions from concrete experiences to solve some problems. For example during one of the sessions the older female talked about 'dipping her

brush in paint'. In another instance when one of the children accidentally got into 'fat bits' the older male started acting like a fat man.

Another aspect of the language analysis was the amount of self talk or private speech used by the children. This was particularly true of the oldest male who used self talk to guide himself through a task. Child psychologists who have studied private speech find it to be a transitional stage between verbalized, self directed speech and internal thought (Berk, 1985). Fuson (1979) says that private speech may be one of the ways that children regulate themselves and that it may be used in different degrees by different children.

Language was the used to ask questions and seek clarifications about the use of the keyboard to type. In addition to using the keyboard, it was noted that the children also used the pencil as a tool to write with.

L-T When I'm finished (using the keyboard) I want to write something

T-L ...you wrote Leila, you wrote your name with the pencil. There's a R, an O, a S, a E.....

In this study the role of the teacher was one of a facilitator helping children make the transition between what they could presently accomplish independently and what they could do in a supportive environment.

Variations in language used over sessions

While there was a difference in the total amount spoken by each child, all four children had approximately the same percentage of comments in the four categories. There was, however, a noted difference in the amount of language used during the eight sessions. This difference can be attributed partly to the fact that during the earlier sessions, the children were less vocal because of the new environment. In their research project, Beaty and Tucker (1987) found there was little

conversation between partners when introduced to a new program. By the third and fourth sessions the children had , experimented and manipulated the medium and were in the process of attaining mastery over it. There was thus a greater amount of vocalization in terms of seeking explanations, giving explanations, focusing attention, stating preferences and stating desires.

Children need to become competent computer users before they are able to share information with their peers. This may also have contributed to the differences in the amount spoken during the eight sessions. Perlmutter, Behrend and Muller (1986) suggest that the skills required to coordinate interpersonal relations and transmission of information are not developed in younger preschool children as compared to the older ones. In addition the length of the sessions as well as the focus of the particular lesson might have contributed to the differences.

There was a peak (see Figure 1) in responses during the session 3 and 4 and then during session 6, and language use deceased during sessions 2 and 5. This was true for the four main categories. There was a general increase in responses for the child directed, child informing, expressions and child inquiry category during sessions 3, 4 and 6, and a decrease in sessions 2 and 5.

Insert Figure 1 About Here

Conclusions

The computer experience provided an opportunity for a wide range of language use. While all four children used primarily the Child Directing and Child Informing functions of language, they also asked questions and used expressions to convey their inner feelings and emotions. The amount of language used that was unrelated to the computer class was minimal.

Language used indicated a high level of interest in the computer class. The children were interested in the capabilities of the computer and in discovering how to make the software program do what it was that they wanted it to do. Language was thus used to state preferences, state desires, to focus attention and to describe what they were doing at the computer.

There was a peak in the amount of language used once the children became comfortable with the software. Initially language was used in the form of private speech, and that formed the transition between internal thought and verbalized speech. In the latter sessions children's speech became more socialized. Children thus need time to work at the computer and become familiar with it before socialized speech becomes apparent. Limited verbalization by the younger children indicated that they required more time to become comfortable with the medium.

There was less verbalization during the earlier sessions and an increase after the third session. Language was used to work out solutions and to solve problems. Large amounts of self talk was used to guide themselves through a task. In the latter sessions language was used to first explain ideas about what they wanted to make and then the children proceeded to execute their actions. Older children used graphic descriptions from concrete experiences to solve problems. Younger children were less verbal that the older ones, however the overall patterns of language used were similar among all 4 children.

Educational Implications

The problem of integrating computer activities into classrooms for young children has raised many questions regarding appropriate activities, isolation of child and socialization. Studying specific areas of development in relation to the computer is thus an important contribution to the emerging research on the impact of computers on young children.

This study indicates that children are fascinated by the computer graphics and quickly learn the instructions and activities necessary to use the medium. While choosing software teachers must be careful that the program allows children to think and question. If appropriately placed, the interactions at the computer can facilitate use of language and social interactions.

This study develops and uses a typology of language which can be used in further replications. Studies on language used at the computer can provide information about the children's interests, concerns and thoughts and form the basis for appropriate computer usage in preschool classrooms.

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Table 1
Typology of Language Used to Code Data

Main Categories	Sub Categories
Child Directed	• Focus attention • Give directions • Make a request • State desire • State intent • State preferences • Indicate personal feelings • Self talk
Child Informing	• Indicate ability to perform task • Describe depictions • Evaluate • Give explanations • Indicate knowledge to perform tasks • Reason • State facts about the computer
Child Inquiry	• Seek clarifications • Seek confirmation • Seek explanations • Self directed questions • Questions about spelling, keyboard etc.
Expressions	• Excitement • Frustration • Interest • Success • Surprise

Figure 1
Breakdown of Language by Type-and Session